CLAIMS

What is claimed is:

1. An apparatus for producing an inhomogeneously polarized optical beam from a homogeneously polarized homogeneously polarized input optical beam, the apparatus comprising:

a first phase shifter which shifts at least one portion of a first part of the homogeneously polarized input optical beam by a first phase; and

a second phase shifter which shifts at least one portion of a second part of the homogeneously polarized input optical beam by substantially the first phase;

one or more polarization beam splitters that split the homogeneously polarized input optical beam into the first part and the second part and combine the phase shifted portion and substantially all other portions of the first part of the input optical beam with the phase shifted portion and substantially all other portions of the second part of the input optical beam to produce the inhomogeneously polarized optical beam.

2. The apparatus as set forth in claim 1 further comprising a source for the homogeneously polarized input optical beam.

3. The apparatus as set forth in claim 1 further comprising a polarizer that polarizes the homogeneously polarized input optical beam to a first angle with respect to a first axis.

4. The apparatus as set forth in claim 3 wherein the first angle is substantially forty-five degrees.

5. The apparatus as set forth in claim 1 wherein the one or more polarization beam splitters comprise:

a first polarization beam splitter that splits the homogeneously polarized input optical beam into the first part and the second part; and

a second polarization beam splitter that combines the phase shifted portion and substantially all other portions of the first part of the input optical beam with the phase shifted portion and substantially all other portions of the second part of the input optical beam to produce the inhomogeneously polarized optical beam.

6. The apparatus as set forth in claim 5 wherein the polarization converter further comprises a variable delay that delays the second part of the input optical beam a first period of time.

7. The apparatus as set forth in claim 5 wherein the polarization converter further comprises a first spatial filter connected to an input of the first polarization beam splitter.

8. The apparatus as set forth in claim 5 wherein the polarization converter further comprises a second spatial filter connected to an output of the second polarization beam splitter.

9. The apparatus as set forth in claim 1 wherein the one or more polarization beam splitters comprise a single polarization beam splitter that splits the homogeneously polarized input optical beam into the first part and the second part and combines the first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

10. The apparatus as set forth in claim 9 wherein:

the first phase shifter is a first step divided mirror where a reflection of the at least a portion of the transmitted first part of the input optical beam is provided from each side of the first step divided mirror; and

the second phase shifter is a second step divided mirror where a reflection of the at least a portion of the transmitted second part of the input optical beam is provided from each side of the second step divided mirror.

11. The apparatus as set forth in claim 10 wherein the polarization converter further comprises:

a first wave adjustment device between the single polarization beam splitter and the first phase shifter, the first wave adjustment device converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

a second wave adjustment device between the single polarization beam splitter and the second phase shifter, the second wave adjustment device converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

12. The apparatus as set forth in claim 11 wherein:

the first wave adjustment device converts the transmitted first part of the input optical beam to a circular polarization and converts the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the second wave adjustment device converts the transmitted second part of the input optical beam to a circular polarization and converts the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

13. The apparatus as set forth in claim 11 wherein the first wave adjustment device is a first quarter wave plate and the second wave adjustment device is a second quarter wave plate.

14. The apparatus as set forth in claim 1 wherein the polarization beam splitter has a surface positioned at a Brewster angle with respect to a direction of propagation of the input optical beam along a first axis, the polarization beam splitter splits the homogeneously polarized input optical beam and transmits a first part of the input optical beam and a second part of the input optical beam and

combines a reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

15. The apparatus as set forth in claim 14 wherein:

the first phase shifter is a first step divided mirror where a reflection of the at least a portion of the transmitted first part of the input optical beam is provided from each side of the first step divided mirror; and

the second phase shifter is a second step divided mirror where a reflection of the at least a portion of the transmitted second part of the input optical beam is provided from each side of the second step divided mirror.

16. The apparatus as set forth in claim 15 wherein the polarization converter further comprises:

a first wave adjustment device between the polarization beam splitter and the first phase shifter, the first wave adjustment device converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

a second wave adjustment device between the polarization beam splitter and the second phase shifter, the second wave adjustment device converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

17. The apparatus as set forth in claim 16 wherein:

the first wave adjustment device converts the transmitted first part of the input optical beam to a circular polarization and converts the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the second wave adjustment device converts the transmitted second part of the input optical beam to a circular polarization and converts the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

18. The apparatus as set forth in claim 16 wherein the first wave adjustment device is a first quarter wave plate and the second wave adjustment device is a second quarter wave plate.

19. An apparatus for producing an inhomogeneously polarized optical beam from a homogeneously polarized input optical beam, the apparatus comprising:

a first polarization beam splitter that splits the homogeneously polarized input optical beam into a first part and a second part;

a first phase shifter which shifts at least one portion of the first part of the input optical beam by a first phase;

a second phase shifter which shifts at least one portion of the second part of the input optical beam by substantially the first phase; and

a second polarization beam splitter which combines the phase shifted portion and substantially all other portions of the first part of the input optical beam with the phase shifted portion and substantially all other portions of the second part of the input optical beam to produce the inhomogeneously polarized optical beam.

20. The apparatus as set forth in claim 19 further comprising a source for the input optical beam.

21. The apparatus as set forth in claim 19 further comprising a polarizer that polarizes the homogeneously polarized input optical beam to a first angle with respect to a first axis.

22. The apparatus as set forth in claim 21 wherein the first angle is substantially forty-five degrees.

23. The apparatus as set forth in claim 19 further comprising a variable delay that delays the second part of the input optical beam a first period of time.

24. The apparatus as set forth in claim 19 further comprising a first spatial filter connected to the input of the first polarization beam splitter.

25. The apparatus as set forth in claim 19 further comprising a second spatial filter connected to an output of the second polarization beam splitter.

26. A method for producing an inhomogeneously polarized optical beam from a homogeneously polarized input optical beam, the method comprising:

splitting the homogeneously polarized input optical beam into a first part and a second part;

shifting at least one portion of the first part of the input optical beam by a first phase;

shifting at least one portion of the second part of the input optical beam by substantially the first phase; and

combining the phase shifted portion and substantially all other portions of the first part of the input optical beam with the phase shifted portion and substantially all other portions of the second part of the input optical beam to produce the inhomogeneously polarized optical beam.

27. The method as set forth in claim 26 further providing the homogeneously polarized input optical beam.

28. The method as set forth in claim 26 further comprising polarizing the homogeneously polarized input optical beam to a first angle with respect to a first axis.

29. The method as set forth in claim 28 wherein the first angle is substantially forty-five degrees.

30. The method as set forth in claim 26 further comprising delaying the second part of the input optical beam a first period of time.

31. The method as set forth in claim 26 further comprising spatial filtering the input optical beam.

32. The method as set forth in claim 26 further comprising spatially filtering the inhomogeneously polarized optical beam.

33. An apparatus for producing an inhomogeneously polarized optical beam from a homogeneously polarized input optical beam, the apparatus comprising:

a polarization beam splitter that splits the input optical beam and transmits a first part of the input optical beam and a second part of the input optical beam;

a first reflective phase shifter which reflects and phase shifts a first amount at least a portion of the transmitted first part of the input optical beam back to the polarization beam splitter; and

a second reflective phase shifter which reflects and phase shifts substantially the first amount at least a portion of the transmitted second part of the input optical beam back to the polarization beam splitter;

the polarization beam splitter combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

34. The apparatus as set forth in claim 33 wherein:

the first reflective phase shifter is a first step divided mirror where the reflection of the at least a portion of the transmitted first part of the input optical beam is provided from each side of the first step divided mirror; and

the second reflective phase shifter is a second step divided mirror where the reflection of the at least a portion of the transmitted second part of the input optical beam is provided from each side of the second step divided mirror.

35. The apparatus as set forth in claim 33 further comprising:

a first wave adjustment device between the polarization beam splitter and the first reflective phase shifter, the first wave adjustment device

converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

a second wave adjustment device between the polarization beam splitter and the second reflective phase shifter, the second wave adjustment device converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

36. The apparatus as set forth in claim 35 wherein:

the first wave adjustment device converts the transmitted first part of the input optical beam to a circular polarization and converts the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the second wave adjustment device converts the transmitted second part of the input optical beam to a circular polarization and converts the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

37. The apparatus as set forth in claim 35 wherein the first wave adjustment device is a first quarter wave plate and the second wave adjustment device is a second quarter wave plate.

38. The apparatus as set forth in claim 33 wherein the polarization beam splitter is a plate with a surface which is positioned at a Brewster's angle with respect to a direction of propagation of the input optical beam along a first axis.

39. The apparatus as set forth in claim 33 further comprising a source for the input optical beam.

40. The apparatus as set forth in claim 33 further comprising a polarizer that polarizes the input optical beam to a first angle with respect to a second axis.

41. The apparatus as set forth in claim 40 wherein the first angle is substantially forty-five degrees.

42. A method for producing an inhomogeneously polarized optical beam from a homogeneously polarized input optical beam, the method comprising:

splitting the homogeneously polarized input optical beam and transmitting a first part of the input optical beam and a second part of the homogeneously polarized input optical beam;

reflecting and phase shifting a first amount at least a portion of the transmitted first part of the input optical beam;

reflecting and phase shifting substantially the first amount at least a portion of the transmitted second part of the input optical beam; and

combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

43. The method as set forth in claim 42 further comprising:

converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

44. The method as set forth in claim 43 wherein:

the converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam further comprises converting the transmitted first part of the input optical beam to a circular polarization and converting the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam further comprises converting the transmitted second part of the input optical beam to a circular polarization and converting the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

45. The method as set forth in claim 42 further comprising providing the input optical beam.

46. The method as set forth in claim 45 wherein the input optical beam is provided to have a direction of propagation along a first axis which is at a Brewster angle with respect to a surface of a polarization beam splitter, the splitting of the input optical beam is carried out by the polarization beam splitter.

47. The method as set forth in claim 42 further comprising polarizing the input optical beam to a first angle with respect to a second axis.

48. The method as set forth in claim 47 wherein the first angle is substantially forty-five degrees.

49. An apparatus for producing an inhomogeneously polarized optical beam from a homogeneously polarized input optical beam, the apparatus comprising:

a polarization beam splitter having a surface positioned at a Brewster angle with respect to a direction of propagation of the homogeneously polarized input optical beam along a first axis, the polarization beam splitter splits the homogeneously polarized input optical beam and transmits a first part of the input optical beam and a second part of the input optical beam;

a first reflective phase shifter which reflects and phase shifts a first amount at least a portion of the transmitted first part of the input optical beam back to the polarization beam splitter; and

a second reflective phase shifter which reflects and phase shifts substantially the first amount at least a portion of the transmitted second part of the input optical beam back to the polarization beam splitter;

the polarization beam splitter combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

50. The apparatus as set forth in claim 49 wherein:

the first reflective phase shifter is a first step divided mirror where the reflection of the at least a portion of the transmitted first part of the input optical beam is provided from each side of the first step divided mirror; and

the second reflective phase shifter is a second step divided mirror where the reflection of the at least a portion of the transmitted second part of the input optical beam is provided from each side of the second step divided mirror.

51. The apparatus as set forth in claim 49 further comprising:

a first wave adjustment device between the polarization beam splitter and the first reflective phase shifter, the first wave adjustment device converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

a second wave adjustment device between the polarization beam splitter and the second reflective phase shifter, the second wave adjustment device converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

52. The apparatus as set forth in claim 51 wherein:

the first wave adjustment device converts the transmitted first part of the input optical beam to a circular polarization and converts the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the second wave adjustment device converts the transmitted second part of the input optical beam to a circular polarization and converts the reflected

second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

53. The apparatus as set forth in claim 49 wherein the first wave adjustment device is a first quarter wave plate and the second wave adjustment device is a second quarter wave plate.

54. The apparatus as set forth in claim 49 further comprising a source for the homogeneously polarized input optical beam.

55. The apparatus as set forth in claim 49 further comprising a polarizer that polarizes the homogeneously polarized input optical beam to a first angle with respect to a second axis.

56. The apparatus as set forth in claim 55 wherein the first angle is substantially forty-five degrees.

57. A method for producing an inhomogeneously polarized optical beam, the method comprising:

providing a homogeneously polarized input optical beam, the homogeneously polarized input optical beam having a direction of propagation along a first axis which is at a Brewster angle with respect to a surface of a polarization beam splitter;

splitting the homogeneously polarized input optical beam and transmitting a first part of the input optical beam and a second part of the input optical beam with the polarization beam splitter;

reflecting and phase shifting a first amount at least a portion of the transmitted first part of the input optical beam;

reflecting and phase shifting substantially the first amount at least a portion of the transmitted second part of the input optical beam; and

combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

58. The method as set forth in claim 57 further comprising:

converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

59. The method as set forth in claim 58 wherein:

the converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam further comprises converting the transmitted first part of the input optical beam to a circular polarization and converting the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam further comprises converting the transmitted second part of the input optical beam to a circular polarization and converting the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

60. The method as set forth in claim 57 further comprising polarizing the input optical beam to a first angle with respect to a second axis.

61. The method as set forth in claim 60 wherein the first angle is substantially forty-five degrees.

62. A microscope comprising:

a source for a homogeneously polarized input optical beam;

a polarization converter which produces an inhomogeneously polarized optical beam from the homogeneously polarized input optical beam; and

a microscopic imaging system which captures an image of sample using the inhomogeneously polarized optical beam.

63. The microscope as set forth in claim 62 wherein the polarization converter comprises:

a first polarization beam splitter that splits the homogeneously polarized input optical beam into a first part and a second part;

a first phase shifter which shifts at least one portion of the first part of the input optical beam by a first phase;

a second phase shifter which shifts at least one portion of the second part of the input optical beam by substantially the first phase; and

a second polarization beam splitter which combines the phase shifted portion and substantially all other portions of the first part of the input optical beam with the phase shifted portion and substantially all other portions of the second part of the input optical beam to produce the inhomogeneously polarized optical beam.

64. The microscope as set forth in claim 63 wherein the polarization converter further comprises a variable delay that delays the second part of the input optical beam a first period of time.

65. The microscope as set forth in claim 63 wherein the polarization converter further comprises a first spatial filter connected to an input of the first polarization beam splitter.

66. The microscope as set forth in claim 63 wherein the polarization converter further comprises a second spatial filter connected to an output of the second polarization beam splitter.

67. The microscope as set forth in claim 62 wherein the polarization converter comprises:

a polarization beam splitter that splits the input optical beam and transmits a first part of the input optical beam and a second part of the input optical beam;

a first reflective phase shifter which reflects and phase shifts a first amount at least a portion of the transmitted first part of the input optical beam back to the polarization beam splitter; and

a second reflective phase shifter which reflects and phase shifts substantially the first amount at least a portion of the transmitted second part of the input optical beam back to the polarization beam splitter;

the polarization beam splitter combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

68. The microscope as set forth in claim 67 wherein:

the first reflective phase shifter is a first step divided mirror where the reflection of the at least a portion of the transmitted first part of the input optical beam is provided from each side of the first step divided mirror; and

the second reflective phase shifter is a second step divided mirror where the reflection of the at least a portion of the transmitted second part of the input optical beam is provided from each side of the second step divided mirror.

69. The microscope as set forth in claim 67 wherein the polarization converter further comprises:

a first wave adjustment device between the polarization beam splitter and the first reflective phase shifter, the first wave adjustment device converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

a second wave adjustment device between the polarization beam splitter and the second reflective phase shifter, the second wave adjustment device converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

70. The microscope as set forth in claim 69 wherein:

the first wave adjustment device converts the transmitted first part of the input optical beam to a circular polarization and converts the reflected first part of the input optical beam to a linear polarization which is substantially

orthogonal to the polarization of the transmitted first part of the input optical beam; and

the second wave adjustment device converts the transmitted second part of the input optical beam to a circular polarization and converts the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

71. The microscope as set forth in claim 69 wherein the first wave adjustment device is a first quarter wave plate and the second wave adjustment device is a second quarter wave plate.

72. The microscope as set forth in claim 62 wherein the polarization converter comprises:

a polarization beam splitter having a surface positioned at a Brewster angle with respect to a direction of propagation of the input optical beam along a first axis, the polarization beam splitter splits the input optical beam and transmits a first part of the input optical beam and a second part of the input optical beam;

a first reflective phase shifter which reflects and phase shifts a first amount at least a portion of the transmitted first part of the input optical beam back to the polarization beam splitter; and

a second reflective phase shifter which reflects and phase shifts substantially the first amount at least a portion of the transmitted second part of the input optical beam back to the polarization beam splitter;

the polarization beam splitter combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

73. The microscope as set forth in claim 72 wherein:

the first reflective phase shifter is a first step divided mirror where the reflection of the at least a portion of the transmitted first part of the input optical beam is provided from each side of the first step divided mirror; and

the second reflective phase shifter is a second step divided mirror where the reflection of the at least a portion of the transmitted second part of the input optical beam is provided from each side of the second step divided mirror.

74. The microscope as set forth in claim 72 wherein the polarization converter further comprises:

a first wave adjustment device between the polarization beam splitter and the first reflective phase shifter, the first wave adjustment device converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

a second wave adjustment device between the polarization beam splitter and the second reflective phase shifter, the second wave adjustment device converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

75. The microscope as set forth in claim 74 wherein:

the first wave adjustment device converts the transmitted first part of the input optical beam to a circular polarization and converts the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the second wave adjustment device converts the transmitted second part of the input optical beam to a circular polarization and converts the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

76. The microscope as set forth in claim 74 wherein the first wave adjustment device is a first quarter wave plate and the second wave adjustment device is a second quarter wave plate.

77. A method for microscopic scanning, the method comprising:

providing a homogeneously polarized input optical beam;

producing an inhomogeneously polarized optical beam from the input optical beam; and

capturing a microscopic image using the inhomogeneously polarized optical beam.

78. The method as set forth in claim 77 wherein the producing the inhomogeneously polarized optical beam further comprises:

splitting the input optical beam into a first part and a second part;

shifting at least one portion of the first part of the input optical beam by a first phase;

shifting at least one portion of the second part of the input optical beam by substantially the first phase; and

combining the phase shifted portion and substantially all other portions of the first part of the input optical beam with the phase shifted portion and substantially all other portions of the second part of the input optical beam to produce the inhomogeneously polarized optical beam.

79. The method as set forth in claim 78 wherein the producing the inhomogeneously polarized optical beam further comprises delaying the second part of the input optical beam a first period of time.

80. The method as set forth in claim 78 wherein the producing the inhomogeneously polarized optical beam further comprises spatial filtering the input optical beam.

81. The method as set forth in claim 78 wherein the producing the inhomogeneously polarized optical beam further comprises spatially filtering the inhomogeneously polarized optical beam.

82. The method as set forth in claim 77 wherein the producing the inhomogeneously polarized optical beam further comprises:

splitting the input optical beam and transmitting a first part of the input optical beam and a second part of the input optical beam;

reflecting and phase shifting a first amount at least a portion of the transmitted first part of the input optical beam;

reflecting and phase shifting substantially the first amount at least a portion of the transmitted second part of the input optical beam; and

combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

83. The method as set forth in claim 82 wherein the producing the inhomogeneously polarized optical beam further comprises:

converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

84. The method as set forth in claim 83 wherein:

the converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam further comprises converting the transmitted first part of the input optical beam to a circular polarization and converting the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam further comprises converting the transmitted second part of the input optical beam to a circular polarization and converting the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.

85. The method as set forth in claim 77 wherein the producing the inhomogeneously polarized optical beam further comprises:

splitting the input optical beam and transmitting a first part of the input optical beam and a second part of the input optical beam with a polarization beam splitter, the input optical beam is provided to have a direction of propagation

along a first axis which is at a Brewster angle with respect to a surface of the polarization beam splitter;

reflecting and phase shifting a first amount at least a portion of the transmitted first part of the input optical beam;

reflecting and phase shifting substantially the first amount at least a portion of the transmitted second part of the input optical beam; and

combining the reflected and phase shifted first and second parts of the input optical beam to produce the inhomogeneously polarized optical beam.

86. The method as set forth in claim 85 wherein the producing the inhomogeneously polarized optical beam further comprises:

converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam; and

converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam.

87. The method as set forth in claim 86 wherein:

the converting a polarization of at least a portion of the transmitted and reflected first part of the input optical beam further comprises converting the transmitted first part of the input optical beam to a circular polarization and converting the reflected first part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted first part of the input optical beam; and

the converting a polarization of at least a portion of the transmitted and reflected second part of the input optical beam further comprises converting the transmitted second part of the input optical beam to a circular polarization and converting the reflected second part of the input optical beam to a linear polarization which is substantially orthogonal to the polarization of the transmitted second part of the input optical beam.